

3.1 Intro to Quadratic Relations

So far: Linear Relations	New: Quadratic Relations <i>Standard form</i>
<p>Equation: $y = mx + b$</p> <p>m is slope, b is y-intercept</p> <p>highest exponent of x is 1</p>	<p>Equation: $y = ax^2 + bx + c$</p> <p>a, b, and c are coefficients</p> <p>highest exponent of x is 2 (degree, or order, of 2)</p>

Recall: To graph a relationship, we can use a table of values (or TOV).

1. Pick some values for x (some positive & negative)
2. Sub each x -value into the equation.
3. Determine values for y .
4. Plot each point (x, y) on the x - y plane.
5. (Optional) Calculate first differences, which are the differences between *consecutive* y -values for *consecutive* x -values.

Create a TOV for $y = 2x + 1$

1st differences

x	$y = 2x + 1$	$\Delta y = y_2 - y_1$
-2	$2(-2) + 1 = -3$	
-1	$2(-1) + 1 = -1$	$-1 - (-3) = 2$
0	$2(0) + 1 = 1$	$1 - (-1) = 2$
+1	$2(1) + 1 = 3$	$3 - (1) = 2$
2	$2(2) + 1 = 5$	$5 - (3) = 2$

} constant

' Δ ' (delta) means "change in" or "difference".

Δy is the change in y, or the first difference.

In a linear relationship, the first differences are constant

Ex.1. Create a TOV for $y = x^2$

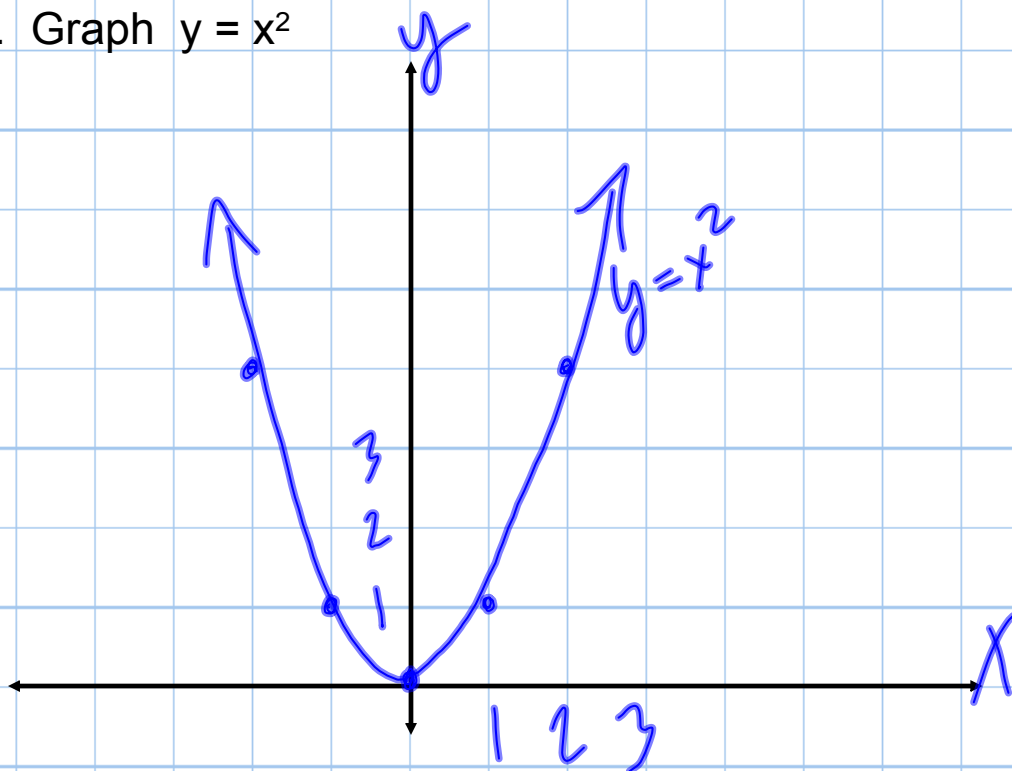
parent

x	$y = x^2$	Δy <i>1st</i>	$\Delta^2 y$ <i>2nd</i>
-2	$(-2)^2 = 4$		
-1	$(-1)^2 = 1$	$1 - (4) = -3$	
0	$(0)^2 = 0$	$0 - (1) = -1$	$-1 - (-3) = 2$
1	$(1)^2 = 1$	$1 - 0 = 1$	$1 - (-1) = 2$
2	$(2)^2 = 4$	$4 - (1) = 3$	$3 - (1) = 2$

$\Delta^2 y$ is the change in Δy , or change in 1st differences.

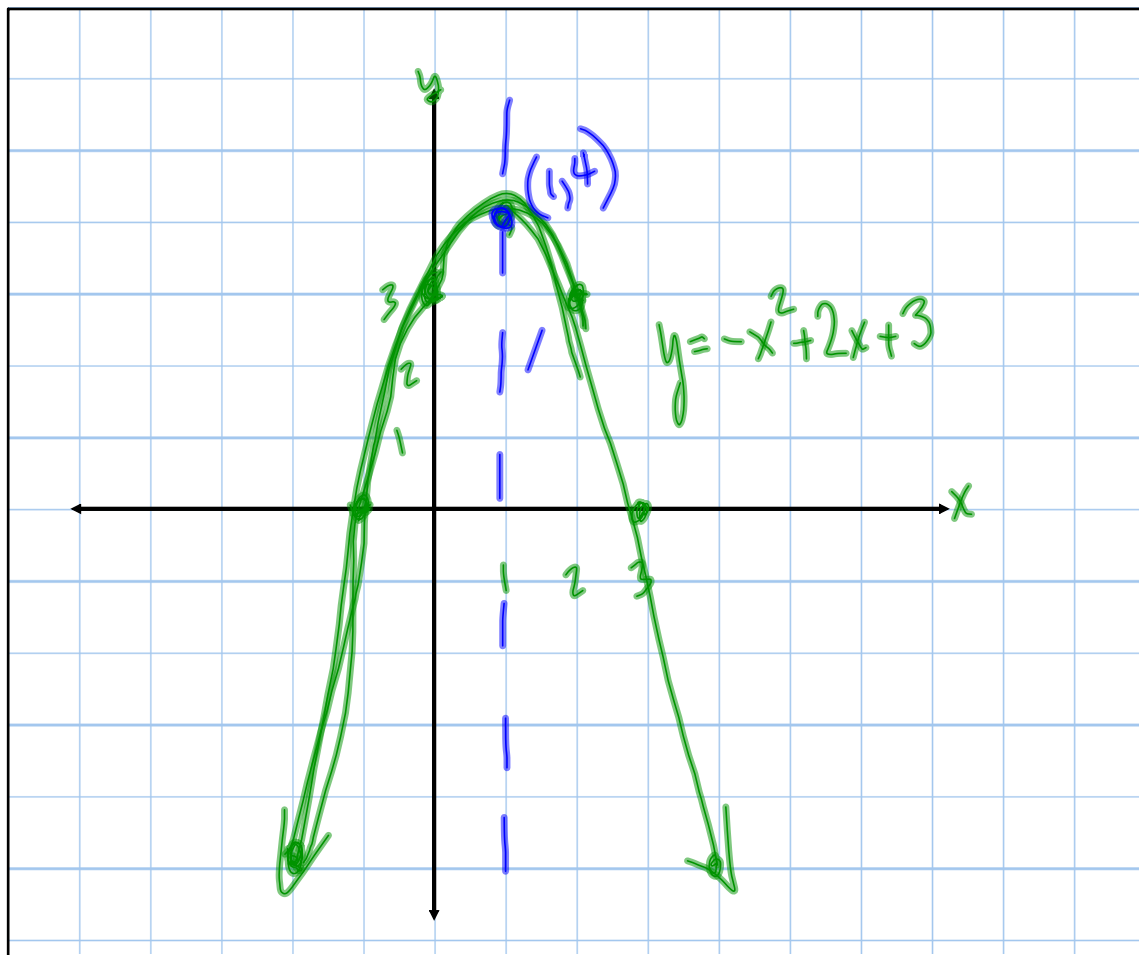
$\Delta^2 y$ is the second difference.

In a quadratic relationship, first differences are different
and second differences are constant.

Ex.2. Graph $y = x^2$ Ex.3. Create a TOV and graph $y = -x^2 + 2x + 3$.

x	$y = -x^2 + 2x + 3$	Δy	$\Delta^2 y$
-2	$-(-2)^2 + 2(-2) + 3 = -5$		
-1	$-(-1)^2 + 2(-1) + 3 = 0$	$0 - (-5) = 5$	
0	$-(0)^2 + 2(0) + 3 = 3$	$3 - 0 = 3$	$3 - 5 = -2$
1	$-(1)^2 + 2(1) + 3 = 4$	$4 - 3 = 1$	$1 - 3 = -2$
2	$-(2)^2 + 2(2) + 3 = 3$	$3 - 4 = -1$	$-1 - 1 = -2$

Graph



For any parabola, $y = ax^2 + bx + c$, the direction of opening can be determined from:

- the graph
- the sign of the 2nd difference *negative down*
- the sign of "a" *+ up*

Positive "a" value
Positive 2nd difference \Rightarrow parabola opens up.

Negative "a" value
Negative 2nd difference \Rightarrow parabola opens down.

Assigned Work:

p. 137 # 1, 2, 3, 4, 5ab, 6, 7